Draft $PM_{(2.5 \text{ and Coarse})}$ Data Analysis Plan

Version 3/14/00

MISSION STATEMENT:

To promote capabilities and undertake analysis of aerometric measurement emissions and model-generated data to describe the nature of $PM_{(2.5 \text{ and Coarse})}$ and regional haze in the United States.

SCOPE:

Characterization of $PM_{(2.5 \text{ and Coarse})}$ both temporally and spatially.

MILESTONES/TIME LINE:

Draft $PM_{(2.5 \text{ and Coarse})}$ Data Analysis Plan	February 2000
Establish Milestones for Objective(s)	March 9, 2000
Pre-brief for Mobley on Draft Plan	March 13, 2000
Brief John Seitz on Draft Plan	March 14, 2000
Finalize $PM_{(2.5 \text{ and Coarse})}$ Data Analysis Plan	March 2000
Regular Meetings (Steering Committee)	Per Schedule

RESOURCES:

In-house Resources - $PM_{(2.5 \text{ and Coarse})}$ Data Analysis "Steering Committee":

Lara Autry (Lead/AQTAG)
Lee Ann Byrd (MQAG)
Ned Meyer (AQMG)
Tom Pace (EFIG)

External Resources - $PM_{(2.5 \text{ and Coarse})}$ Data Analysis "Steering Committee":

None

PROPOSAL:

The Steering Committee will work together to assure coordination of the internal analytical work with external activities that fit into objectives that have been identified. This group will also be responsible for keeping management abreast of the activities as they progress and communicating any directional changes to those working on the analysis.

OBJECTIVE:

INTRODUCTION - General information that will be key to getting the objectives of the plan accomplished.

SPECIFICS:

- ~220 FRM sites will provide complete data for calendar year 1999 (75% data capture for each quarter). NOTE: Remaining ~600 FRM sites will have some 1999 data and a complete year for 2000. Total expected for network is 1,089.
- ~130 Continuous sites are currently operating, and remaining sites should be installed by the end of the summer (i.e., total ~200). Many agencies are currently reporting through the AQI system.
- Initial speciation sites (~13 plus 2 in CA) are operating and will have some limited data in April 2000. Complete speciation network should be operating by December 2000. Total expected for network is 250-300 with 54 operating for trends purposes.
- 8 Supersites will have useful data by 2001.
- IMPROVE expansion to 110 sites nationally is underway, expected complete by end of 2000.
- CASTNET data available.
- From a ten year prospective of what has been occurring with rural $PM_{2.5}$, the 1998 Trends Report shows IMPROVE network data from 1989-1998. (Available around the end of March 2000.)
- FRM data for a complete calendar year (1999) will be available April 1, 2000, according to regulation.
- $PM_{2.5}$ Background (Below bullets taken from $PM_{2.5}$ Data Analysis Workbook).
  - Common $PM_{2.5}$ Emission Sources
  - Properties of PM
  - PM Formation in the Atmosphere
  - Atmospheric Transport of PM
- Data analysis will become more important than ever in performing modeled attainment or reasonable progress demonstrations to estimate whether a proposed control strategy will lead to attainment of air quality goals for $PM_{2.5}$ and regional haze.

PROPOSAL:

Compile key sources of information identified within the Draft $PM_{2.5}$ Data Analysis Workbook, as a starting point, for solid background information. The key sources identified for current work include: existing Draft $PM_{2.5}$ Data Analysis Workbook, abstracts from the PM2000 Conference held in Charleston, IMPROVE annual report, and existing library of references currently in Lara Autry's possession. Ongoing work effort, but currently underway.

OBJECTIVE:

STATE OF THE MONITORING NETWORK - This objective is intended to characterize the existing new monitoring network and evaluate the data being collected.

SPECIFIC QUESTIONS:

- Network Design Characterization
  - Where are the monitors? What type of monitor in each location?
  - How many sites are there?
  - What are the sampling frequencies? What are the reporting frequencies?
  - What are the concentration levels?
- How good are the data being collected?
  - Are the DQOs being achieved?
  - Evaluate the data quality indicators of precision, bias, delectability, representativeness, completeness (including Table L-1 items), and comparability (e.g., is the quality such that data from area A can be compared to data from area B).
  - How well do the different methods intercompare?
    - intercompare mass from different method designations
    - relationships with continuous measurements
    - mass from FRMs vs. mass from speciation samplers
    - species from speciation samplers to IMPROVE samplers
    - data from Supersites relative to national networks
    - data from mini-trends study
    - locally collected data
  - Are Table L-1 and the Validation Template being used and if so , are the criteria still appropriate? Do they need to be modified?
- What data need to be reported and are these being reported?
  - Collocated measurements (P&A transaction or separate POC?)
  - Flagged data
  - What is POC?
- Network design enhancements (questions about changing current network design)
  - Is the sampling frequency too much/too little? Should the sampling frequency vary by season (like ozone)?
  - Are there enough/too many samplers?
  - Are they in the right place?
  - What is the spatial representativeness of the monitors?
  - How appropriate is the siting, especially nearness to sources?
  - Are the correct species being analyzed? How do the species vary spatially and temporally? What species are needed and are they being measured
  - Do the measurements need to be at a finer temporal resolution than 24-hours?
  - All the network design questions should be addressed of the $PM_{2.5}$ QA

network (collocation and PEP). For example, is the precision and bias of the network sufficiently establish ed to reduce collocation of samplers? Do we need more collocation to understand precision and bias? Do we need to collect QA samples with varying seasonal frequencies?

- Mass closure questions:
  - How good is the closure?
  - How does goodness of closure vary temporally and spatially?
  - What are the causes for lack of closure? Species? Met conditions that create artifacts?
- Data Validation
  - Are the data valid?
  - Flag outliers and analyze them.

MILESTONES/TIME LINE:

Brief Bachman/Mobley/Paisie on Preliminary $PM_{2.5}$ Mass QA	March 21, 2000
Large Section of $PM_{2.5}$ Monitoring, Quality Assurance, and Data Analysis Workshop devoted to QA	May 22-25, 2000
Draft $PM_{2.5}$ Mass DQO Peer-Reviewed Paper	June 2000
Draft $PM_{2.5}$ Mass DQA Peer-Reviewed Paper	September 2000
$PM_{2.5}$ Mass QA Report	September 2000

RESOURCES (FTEs):

In-house Resources - Data Quality Assessment Workgroup:

Michael Papp (Lead/MQAG)	-	50%
Shelly Eberly (MQAG)	-	40%
Mark Schmidt (MQAG)	-	20%
Sharon Nizich (MQAG)	-	5%
Tim Hanley (MQAG)	-	10%
Mark Shanis (MQAG)	-	5%
Basil Coutant (AQMG)	-	15%
Terence Fitz-Simons (AQTAG)	-	5%

External Resources:

Allen Rush (OAQPS DC)

OBJECTIVE:

BASIC ANALYSIS (SPATIAL AND TEMPORAL) OF PM - Some key fundamental work that needs to be done in order to answer more complex questions about $PM_{2.5}$.

SPECIFIC QUESTIONS:

- **!** How do secondarily-formed pollutants vary spatially and temporally?
- **!** How do primary pollutants vary spatially and temporally?
  - < Need to compare adjusted direct emissions with measurements.
- **!** How do the pollutants inter relate?
  - < Seasonality (tile map was one suggestion of showing this information). Peaks in each season (winter, spring, summer, fall).
  - < Relationship with other pollutants (e.g., $PM_{2.5}$ on high vs. low ozone days...not just a stratification of temperature). Correlation of other pollutants specifically at high $PM_{2.5}$ levels.
  - < Geographic/regional differences in levels or patterns (e.g., East vs. West for peaks and annual average; urban vs. rural for 24-hour and annual average).
  - < PM_{10} - $PM_{2.5}$ = PM_{Coarse} (Terence has already been performing some analysis on co-located sites with PM_{10} and $PM_{2.5}$ monitors).
  - < Distributions for 24-hour results (all sites).
  - < Chart annual values for all sites.
  - < Speciation summaries.
  - < Analysis/summaries of peak 1-hour values for all sites (i.e., range)
- **!** How do pollutants and emission patterns inter-compare?
  - < How do spatial measurements of Ammonia deposition match up with ammonia inventories?
  - < How do spatial measurements of carbon match up with carbon inventories on both regional and neighborhood scales?
  - < How do ambient measurement of crustal materials match up with fugitive dust emission inventories?
- **!** Support Analysis for Staff Paper (as needs determined)

MILESTONES/TIME LINE:

Staff Paper Analysis	Pre-Schedule
Assessment of Existing Data (i.e., primarily CASTNET) to Provide Picture of Pollutant Interrelation	Early April 2000
Synthesis of Information from Outside (e.g., University work, private sector work, etc.) to Provide Information about Pollutant Interrelation	Ongoing (Initial look April/May)
Assessment of 1999 FRM Data to Show Pollutant Interrelation	Per-Availability
Conceptual Description of Temporal and Spatial Characteristics of Measured $PM_{2.5}$ in the United States	September 2000

RESOURCES (FTEs):

In-house Resources - $PM_{2.5}$ Characterization:

Lara Autry (AQTAG)	-	75%
Bill Cox (AQMG)	-	50%
Shelly Eberly (MQAG)	-	50%
Terence Fitz-Simons AQTAG)	-	50%
Mark Schmidt (MQAG)	-	25-50%
Peter Frechtel (AQTAG)	-	25%
David Mintz (AQTAG)	-	15%
Miki Wayland (AQTAG)	-	15%

External Resources - $PM_{2.5}$ Characterization Subteam:

Michael Rizzo (Region 5)	-	6 week detail, including continued support after departure

OBJECTIVE:

SOURCE APPORTIONMENT ANALYSIS - Evaluation of source apportionment techniques, including comparison of CMB8, UNMIX, and PMF from theoretical and case study points of view. Uncertainties and limitations in source-receptor analysis.
Discerning: Local versus non-local influences, among source categories, among source regions, and among specific source influences. Are there network design issues?

SPECIFIC QUESTIONS:

- Using Emissions Inventories and speciated $PM_{2.5}$ to support SIP Planning for Haze and $PM_{2.5}$.
  - How can emissions inventory and chemically speciated ambient data be used together to estimate the regionality and origins of $PM_{2.5}$?
  - How can EI's be used to evaluate the spatial representativeness of $PM_{2.5}$ measurements?
  - How can receptor modeling be used to augment transport and transformation models in SIPs development?

MILESTONES/TIME LINE:

LONG-TERM PROJECT WORK.

RESOURCES (FTEs):

Accomplished with some mixture of Basic Analysis of PM resources.

OBJECTIVE:

QUANTIFICATION OF PM NAAQS ATTAINMENT STATUS - Designation work conducted by AQSSD with EMAD support.

MILESTONES/TIME LINE:

AQSSD to Establish Schedule at Appropriate Time (approximately 3 year away)

RESOURCES (FTEs):

EMAD resource contribution from some combination of those involved in effort for Basic Analysis of PM.

OBJECTIVE:

INFLUENCES OF PM, MODEL DEVELOPMENT, AND MODEL EVALUATION - Data Analysis will become more important than ever in performing a modeled attainment or reasonable progress demonstrations to estimate whether a proposed control strategy will lead to attainment of air quality goals for $PM_{2.5}$ and Regional Haze. In addition to the usual uses to aid in specifying model inputs, to help evaluate model performance and to provide corroboratory information in weight of evidence determinations, particulate matter's existence as a mixture increases the danger of misapplying models or simulating strategies which could ultimately prove ineffective. A key early step in an attainment demonstration is to develop a conceptual description of an area's PM problem. This helps to orient a model application as well as help select promising strategies to simulate.

SPECIFIC QUESTIONS:

- Identification of periods to model. This will involve looking for climatological regimes and mass composition regimes
  - How does PM/visibility relate to meteorology? What meteorological factors contribute to high/low days?
  - How does one identify periods to model? (This likely will depend on determining different meteorological regimes as well as different mass composition regimes.)
  - How mobile sources effect/versus stationary sources effect/versus ambient sources? How regional areas effect/versus local areas?
  - Comparison with REMSAD and MODELS3.
- Develop meteorologically-adjusted PM trends.
  - What does the FRM measure? The sum of the species is usually <70% of the mass. What is this missed part? How does it vary meteorologically, temporally, spatially, and compositionally?
- How important are natural events, such as, wildfires and dust storms?
- Ambient and emission inventory trends.
- Integration of data/analysis of what is learned from Supersites.
- How can the general characterization of $PM_{2.5}$ be used to determine how well the air quality simulation models predict $PM_{2.5}$ and its components? Is ti possible to use ambient $PM_{2.5}$ to evaluate whether the changes in air quality predicted by the models are correct for the changes in emissions, i.e., do the models have good sensitivity?
- Application of attainment demonstration.

- APPROACH TO DEVELOP THE MEANS TO ADDRESS THE QUESTIONS ABOVE:
  - Evaluate performance of and apply the REMSAD grid model for a year over the contiguous United States to:
    - compare predicted and observed proportions of components of

secondary $PM_{2.5}$ (i.e., sulfates and nitrates);

- **S** note predicted spatial and temporal patterns of $PM_{2.5}$ and its components; and
- **S** assess sensitivity of primary and secondary components of $PM_{2.5}$ to control strategies.

< Evaluate performance of CMAQ in the contiguous United States to:

- **S** identify practical tips for applying the model for subsequent regulatory applications;
- **S** position ourselves to address questions previously addressed with REMSAD; and
- **S** develop a basis for comparing conclusions reached with REMSAD versus those with the more complete physicochemical description provided in CMAQ.

< Use model results as well as analysis of ambient data to address a series of questions about how States/Regional Planning Bodies should perform attainment and reasonable progress demonstrations. Examples of questions we wish to address include:

1. How many days do we need to simulate to reach conclusions similar to those obtained by simulating everyday in a year?
2. how good does model performance have to be fore us to have a high degree of confidence in predicted effects of a control strategy?
3. How do we normalize trends in $PM_{2.5}$ and its components for interannual meteorological differences so that this information can be used in weight of evidence analyses?

< Develop and coordinate guidance for demonstrating attainment of the $PM_{2.5}$ NAAQS and of the goals for reducing regional haze:

- **S** define attainment and reasonable progress tests;
- **S** how to do weight of evidence analyses?
- **S** what is a “conceptual description”?
- **S** how to develop a modeling/analysis protocol;
- **S** selecting appropriate model(s);
- **S** choosing days to model;
- **S** selecting domain size and resolution;
- **S** developing meteorological inputs;
- **S** developing emissions inputs; and
- **S** evaluating model performance and using diagnostic tests.

MILESTONES/TIME LINE:

Complete and Circulate First Draft of Modeling Guidance	April 2000
Conduct a National Workshop on Use of CMAQ	June 2000
Upgrade REMSAD to be Consistent with 1999 Peer Review Comments	July 2000

Complete Set of REMSAD Runs with “1996" Meteorology and for 4-5 Strategies Reducing $PM_{2.5}$ and/or Its Precursors. Develop Characterization of $PM_{2.5}$, Its Components and Sensitivities to Prospective Control Measures, and Presents to Regional Planning Bodies. August 2000

Report Results of Efforts to Normalize Observed Trends in $PM_{2.5}$ and Its Components for Meteorological Differences August 2000

Perform Limited Additional REMSAD Sensitivity Tests to Help Address Questions Regarding Needed Level of Model Performance (Subject to agreement among REMSAD modeling team.) September 2000

Apply Climatological Relative Humidity Information (being developed under contract for AQSSD) in Concert with Previously Developed REMSAD Results to Provide a Conceptual Description of “Climatologically Normalized” Visibility in the Contiguous U.S., as well as Its Sensitivity to Prospective Regional Control Strategies October 2000

Complete Analyses of REMSAD-generated Data to Improve Basis for Second Draft of Guidance on Episode Selection and Performance Evaluation October 2000

Complete and Circulate Second Draft of PM/RH Modeling Guidance November 2000

Complete Fine Scale CMAQ Application for a Limited Period in 1996 for PM and Ozone in the Eastern U.S. December 2000

Complete Coarse Scale CMAQ Annual Application with Base Case 1996 Emissions and Meteorology for the Contiguous U.S. December 2000

RESOURCES (FTEs):

Approximately 3-5FTE’s.

OBJECTIVE:

EMISSIONS INVENTORY - Purpose of PM emission inventory development: used by regulatory community; air quality modeling support (model input); exposure modeling support, health assessment; analysis of control costs; and regulatory control strategy development.

SPECIFIC QUESTIONS:

- Evaluating Emissions Inventories by relating the magnitude of the emissions of $PM_{2.5}$ and its precursors to measured concentrations of carbonaceous, crustal and secondary aerosols.
  - What tools are available to States to evaluate their emission inventories of $PM_{2.5}$ and its precursors by comparing the inventory directly to ambient measurements of $PM_{2.5}$ and chemical speciated $PM_{2.5}$?
  - Which of these tools can we expect States to use and which will they need expert Contractor assistance to use effectively?
  - What examples do we have that we can show to potential users, especially those in State emission inventory groups?

MILESTONES/TIME LINE:

NEED TO ESTABLISH THESE

RESOURCES (FTEs):

Accomplished with some mixture of Basic Analysis of PM resources

OBJECTIVE:

GUIDANCE - Document decisions and provide information to the general public to help address $PM_{2.5}$, regional haze, and visibility.

SPECIFIC QUESTIONS:

- Guidance on how to model PM and regional haze
- $PM_{2.5}$ Data Analysis Workbook
- UNMIX/PMF Workshop
- APTI Course
- Guidance on Natural Visibility Conditions and Tracking Progress Under Regional Haze Program
- $PM_{2.5}$ Monitoring, Quality Assurance, and Data Analysis Workshop

MILESTONES/TIME LINE:

UNMIX/PMF Workshop	February 14-16, 2000
Initial Draft Guidance for Demonstrating Attainment of $PM_{2.5}$ and Regional Haze Goals	April 2000
$PM_{2.5}$ Monitoring, Quality Assurance, and Data Analysis Workshop	May 22-25, 2000
Finalize Draft $PM_{2.5}$ Data Analysis Workbook	June 2000
Draft Guidance for Tracking Progress Under Regional Haze Program	September 2000
Draft Guidance for Demonstrating Attainment of $PM_{2.5}$ and Regional Haze Goals	October 2000
Draft Guidance for Natural Visibility Conditions	October 2000
Final Guidance for Tracking Progress Under Regional Haze Program	March 2001
Final Guidance for Natural Visibility Conditions	April 2001

RESOURCES (FTEs/$$$):

In-house Resources:

Shelly Eberly	-	Lead, UNMIX/PMF Workshop
Lee Ann Byrd	-	Lead, $PM_{2.5}$ Workshop
Lara Autry	-	Lead, $PM_{2.5}$ Workbook Lead, Guidance for Tracking Progress Under Regional Haze Program Lead, Guidance for Natural Visibility Conditions
Ned Meyer	-	Lead, Guidance for Demonstrating Attainment of $PM_{2.5}$ and Regional Haze Goals

External Resources - $PM_{2.5}$ Guidance Subteam:

AQSSD Staff Coordination with Guidance Documents

National Parks and Recreation Service Coordination with Guidance Documents